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OCCURRENCE OF EASTERN DWARF MISTLETOE ON BLACK SPRUCE IN SIX NATIONAL FORESTS IN THE LAKE STATES

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INTRODUCTION

Eastern dwarf mistletoe (Arceuthobium pusillum Peck) is reported to be the most serious disease of black spruce (Picea mariana Peck) in the Lake States (4). The disease is also found occasionally on white spruce (Picea glauca (Moench.) Voss) and tamarack (Larix laricina (Du Roi) K. Koch.). It occurs in New England and Canada in addition to the Lake States (3).

The disease is characterized by the development of brooms caused by the dwarf mistletoe parasite. The brooms enlarge and cause a reduction in tree vigor which ultimately results in death of the host. Aerial shoots of A. pusillum can be found in the brooms (4).

A 1949 estimate showed that 10 percent of the 2.2 million acres of black spruce stands were infected with eastern dwarf mistletoe in the Lake States (1). A 1975 survey of the Upper Peninsula of Michigan showed that 17 percent of the black spruce stands were infected and that the distribution of the disease in commercial and non-commercial stands was equal (2).

OBJECTIVE

The purpose of this survey, conducted in 1975-76, was to provide specific information on the incidence of eastern dwarf mistletoe in the six National Forests (Figure 1).

MATERIALS AND METHODS

Each of the six National Forests was separated into six-mile square grids with variations due to the road system. All black spruce stands were examined for eastern dwarf mistletoe along the roads of each grid system. The presence or absence of eastern dwarf mistletoe, percentage of stems infected and geographic locations were recorded for each stand.

Stand location and infection data were plotted on a small scale map for pattern recognition analysis. The gross land area of each National Forest was classified as either no black spruce, black spruce with no eastern dwarf mistletoe, 50 percent or less of stands infected or over 50 percent of stands infected.

RESULTS

Examination of 857 black spruce stands during the survey showed that 15 percent were infected with eastern dwarf mistletoe. The data are summarized in Table I by National Forest and other ownership. Fourteen percent of the infected stands had over 50 percent of the stems infected, 17 percent had from 26 percent to 50 percent of stems infected and 69 percent had 1 to 25 percent of the stems infected (Table II).

When plot locations in each forest were grouped into the five area classifications, 8 percent of the land area on the average had heavy infection (over 50 percent of the stands) 41 percent had moderate to light infection (49 percent to 1 percent of the stands), 32 percent had black spruce but no mistletoe, and 19 percent had no black spruce (Figure 2-7).

Eastern dwarf mistletoe was found occasionally on white spruce and tamarack in the Chequamegon and Ottawa National Forests.

DISCUSSION

This survey showed that eastern dwarf mistletoe of black spruce is not present in epidemic proportions overall.

Eastern dwarf mistletoe of black spruce does not occur at random throughout the survey area, but is found in an identifiable pattern. The mistletoe distribution in Figures 2, 5, 6, and 7 shows that there are areas of heavy infection bordered by areas of lesser infection which in turn are bordered by areas of no infection. However, in the infected areas there are stands of healthy spruce present. Since eastern dwarf mistletoe seed is shot only about 50 feet by the parent plant and the annual rate of spread averages 1 to 2 feet per year, it suggests that vectors such as birds may be partly responsible for the long distance dissemination of mistletoe seeds (5). The current heavily infected areas may have been fire exclusion areas from years past. These could have served as reservoirs from which bird vectors can carry seed to adjacent healthy stands of spruce causing new infection.

Where control measures are not initiated, it seems probable that heavily infected areas will enlarge, the medium to light areas will develop heavy infection and the non-infected areas will become infected. Thus the impact on the black spruce resource in the Lake States will become more serious in future years. Control criteria and recommendations are found in the new black spruce management guide (4).

Table I.--Black spruce stands infected with dwarf mistletoe on six National Forests in the Lake States by ownership 1975-76

National Forest	Percent Total Stands Infected	Ownership of Infected Stands		
		NF	Other	Stands Occurring Jointly On NF and Other Lands
		Percent		
Chequamegon	26(89)[1/]	73	11	16
Chippewa	13(88)	9	45	46
Hiawatha	21(73)	73	27	0
Nicolet	22(77)	58	35	7
Ottawa	11(119)	46	54	0
Superior	11(411)	52	36	12

1/ Total number of stands examined.

Table II.--Classification of black spruce stands infected with eastern dwarf mistletoe based on the percentage of trees infected in each stand, for all ownerships 1975-76

National Forest	Percentage of Stands Infected (By Class)		
	Heavy (100-51%)	Medium (50-26%)	Light (25-1%)
Chequamegon	26	17	57
Chippewa	2	18	80
Hiawatha	13	20	67
Nicolet	12	29	59
Ottawa	0	7	93
Superior	30	13	57

Table III.--Percentage of total land area classified by mistletoe infection zone on each forest

National Forest	Classification (Percent of Stands)			
	No Black spruce	No Mistletoe	1-50% Mistletoe	51-100% Mistletoe
Chequamegon	26	11	37	26
Chippewa	12	18	70	0
Hiawatha	15	41	39	5
Nicolet	29	26	37	8
Ottawa	32	48	17	3
Superior	0	48	47	5

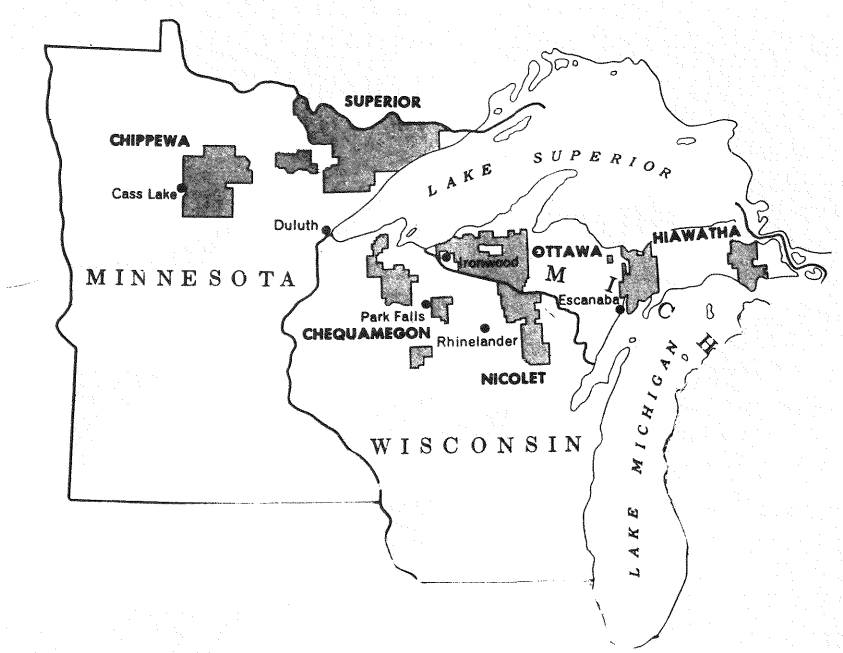

Figure 1.--Geographic location of National Forests surveyed for dwarf mistletoe of black spruce

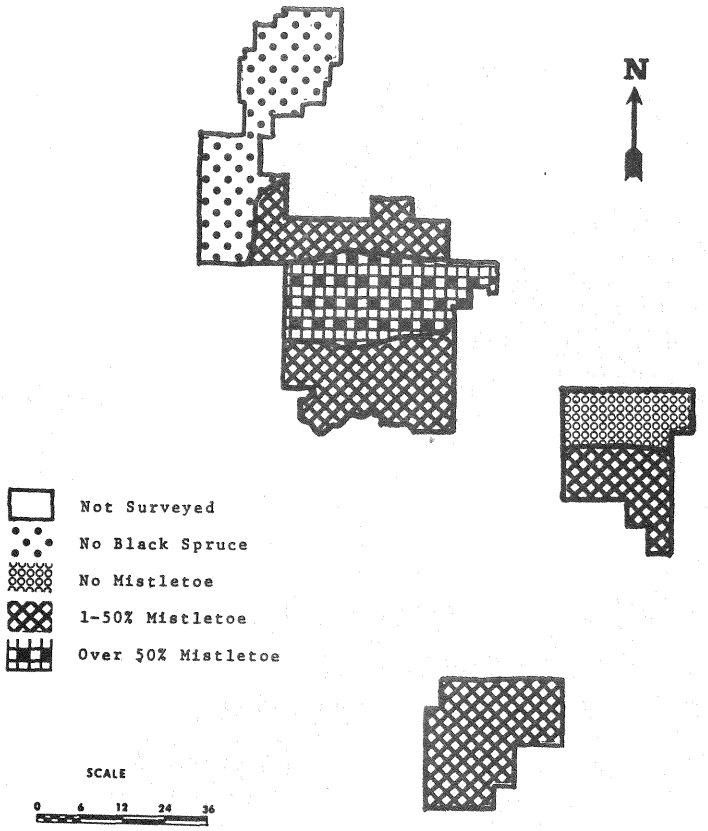

Figure 2.--Zones of black spruce mistletoe infection in the Chequamegon National Forest, Wisconsin, by percentage of stands infected in a given area

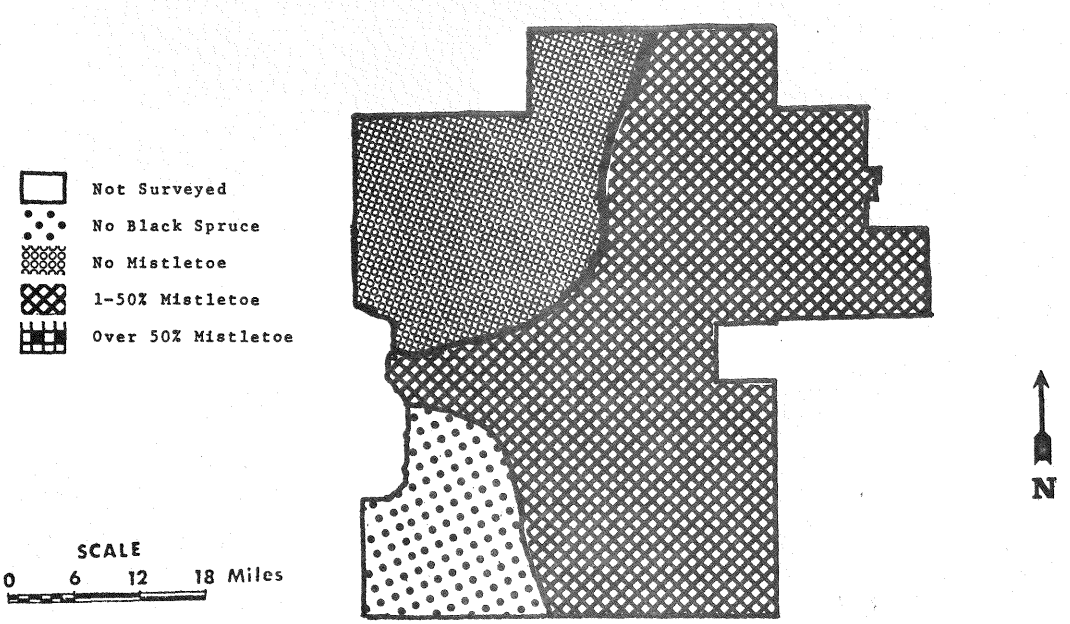

Figure 3.--Zones of black spruce mistletoe infection in the Chippewa National Forest, Minnesota, by percentage of stands infected in a given area

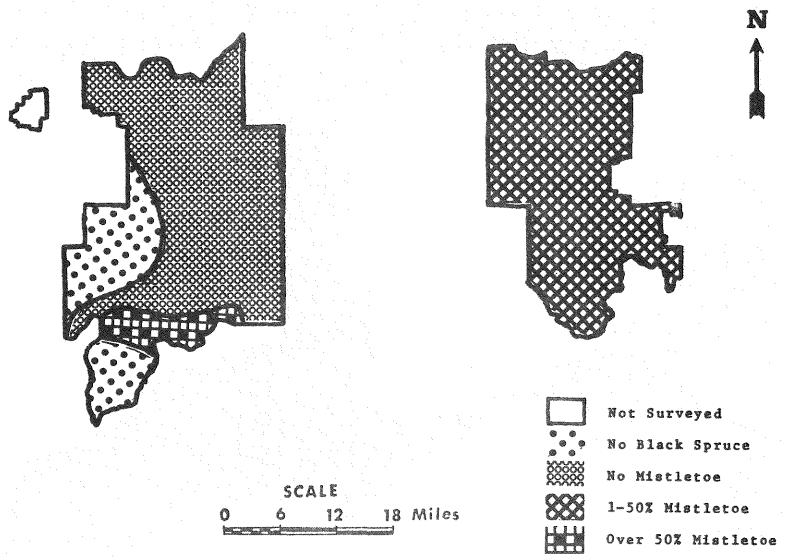

Figure 4.--Zones of black spruce mistletoe infection in the Hiawatha National Forest, Michigan, by percentage of stands infected in a given area

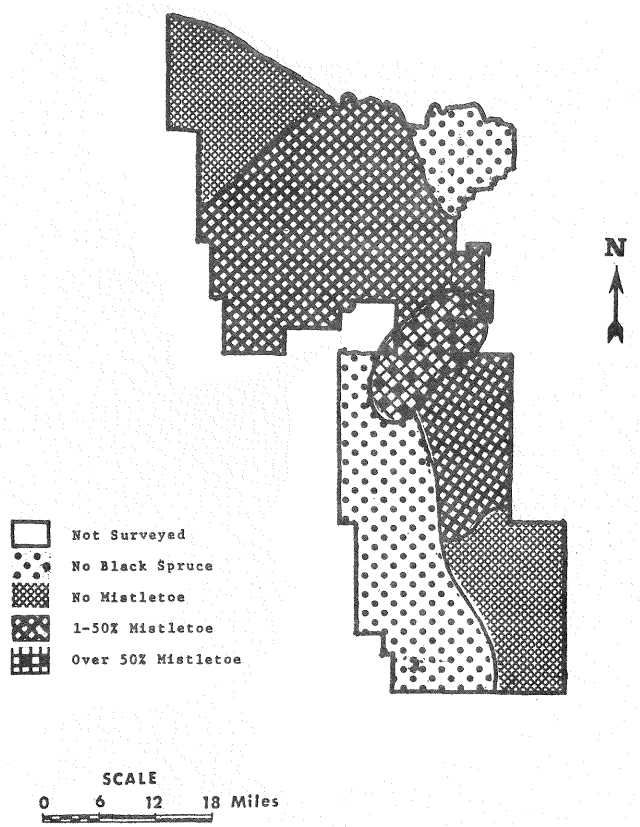

Figure 5.--Zones of black spruce mistletoe infection in the Nicolet National Forest, Wisconsin, by percentage of stands infected in a given area

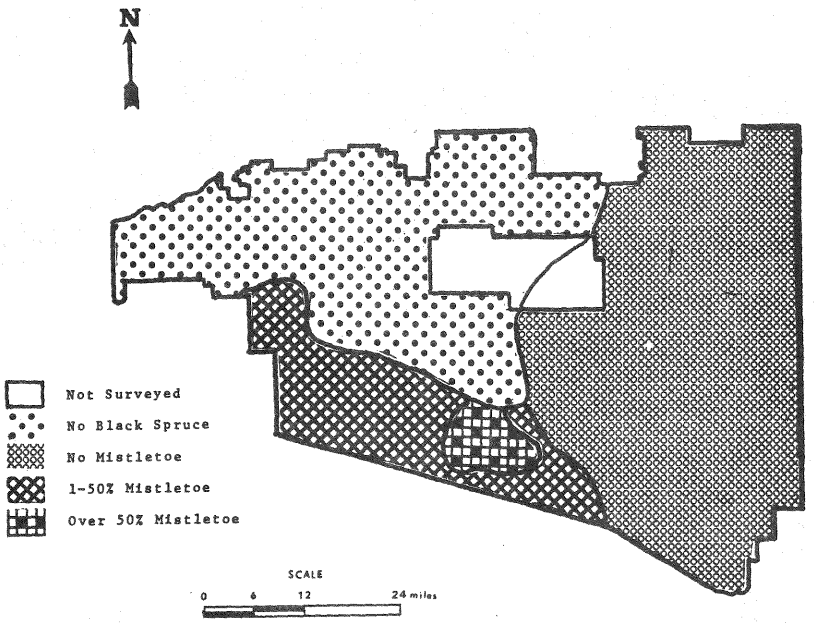

Figure 6.--Zones of black spruce mistletoe infection in the Ottawa National Forest, Michigan, by percentage of stands infected in a given area

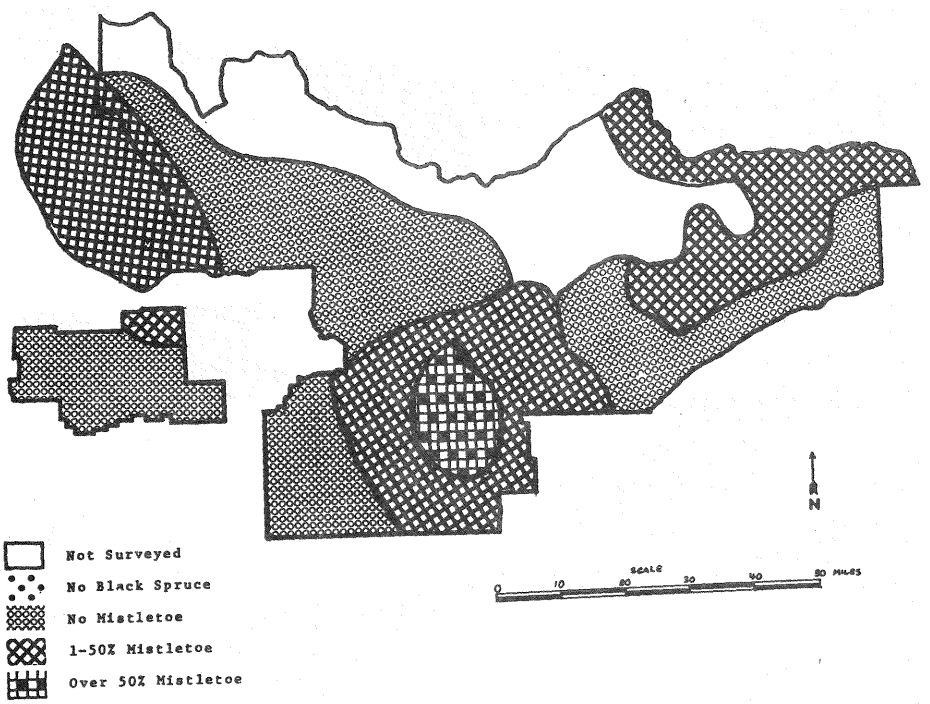

Figure 7.--Zones of black spruce mistletoe infection in the Superior National Forest, Minnesota, by percentage of stands infected in a given area

LITERATED CITED

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3. Hawksworth, F. G. and D. Weins. 1972. Biology and classification of dwarf mistletoes (Arceuthobium). Agric. Handb. No. 401, Forest Service, U. S. Department of Agriculture

4. Johnson, William. 1977. Black spruce management guide, North Central Forest Exp. Sta. (In press).

5. Ostry, M. E. and T. H. Nicholls. 1976. How to identify eastern dwarf mistletoe on black spruce. North Central Forest Exp. Sta., Forest Service, U. S. Department of Agriculture.